

RIVER AND FLOODS.

FLOODS DURING DECEMBER.

By H. C. FRANKENFIELD, Meteorologist.

[Weather Bureau, Washington, January 28, 1921.]

Another month passed without floods of serious character, although moderate floods were more numerous than in November, 1920. With the exceptions of those in the Connecticut, the upper Susquehanna and the Willamette Rivers, the floods occurred in the Southern rivers, and they are summarized in the following table:

Flood stages during month of December, 1920.

| River and station. | Flood stage. | Above flood stages—dates. | | Crest. | |
|-------------------------------|--------------|---------------------------|------|--------------|------------|
| | | From— | To— | Stage. | Date. |
| ATLANTIC DRAINAGE. | | | | | |
| <i>Connecticut:</i> | <i>Feet.</i> | | | <i>Feet.</i> | |
| White River Junction, Vt..... | 13 | 15 | 16 | 14.5 | 15 |
| Hartford, Conn..... | 16 | 16 | 13 | 18.8 | 17 |
| <i>Hoosick:</i> | | | | | |
| Hoosick Falls, N. Y..... | 3 | 6 | 6 | 3.6 | 6 |
| <i>Susquehanna:</i> | | | | | |
| Oneonta, N. Y..... | 12 | 3 | 3 | 13.7 | 3 |
| <i>James:</i> | | | | | |
| Columbia, Va..... | 18 | 1 | 1 | 21.0 | 1 |
| <i>Roanoke:</i> | | | | | |
| Weldon, N. C..... | 30 | (*) | 4 | 38.4 | 3 |
| <i>Tar:</i> | | | | | |
| Greenville, N. C..... | 14 | 14 | 14 | 14.0 | 14 |
| <i>Neuse:</i> | | | | | |
| Neuse, N. C..... | 14 | 1 | 1 | 14.2 | 1 |
| Do..... | 14 | 9 | 12 | 16.2 | 9 |
| Do..... | 11 | 29 | 30 | 14.3 | 30 |
| Smithfield, N. C..... | 14 | 2 | 3 | 15.3 | 2 |
| Do..... | 14 | 9 | 12 | 17.6 | 11 |
| <i>Cape Fear:</i> | | | | | |
| Elizabethtown, N. C..... | 22 | 3 | 3 | 22.4 | 3 |
| Do..... | 22 | 10 | 17 | 30.2 | 12 |
| Do..... | 22 | 30 | 30 | 23.3 | 30 |
| Fayetteville, N. C..... | 35 | 10 | 11 | 42.0 | 10 |
| <i>Pee dee:</i> | | | | | |
| Cheraw, S. C..... | 27 | 10 | 10 | 28.9 | 10 |
| <i>Santee:</i> | | | | | |
| Rimini, S. C..... | 12 | 1 | (**) | 14.1 | 19, 20 |
| Ferguson, S. C..... | 12 | 3 | (**) | 13.5 | 20 |
| EAST GULF DRAINAGE. | | | | | |
| <i>Alabama:</i> | | | | | |
| Montgomery, Ala..... | 35 | 24 | 25 | 35.5 | 24 |
| Selma, Ala..... | 35 | 25 | 28 | 38.0 | 26 |
| <i>Coosa:</i> | | | | | |
| Gadsden, Ala..... | 22 | 16 | 19 | 22.4 | 17, 18 |
| Lock No. 4, Ala..... | 17 | 15 | 20 | 18.2 | 16 |
| <i>Etowah:</i> | | | | | |
| Canton, Ga..... | 11 | 14 | 15 | 20.0 | 14 |
| <i>Cahaba:</i> | | | | | |
| Centerville, Ala..... | 25 | 14 | 14 | 26.0 | 14 |
| <i>Tombigbee:</i> | | | | | |
| Demopolis, Ala..... | 39 | 25 | (**) | 45.6 | 30 |
| <i>Pascagoula:</i> | | | | | |
| Merrill, Miss..... | 20 | 27 | (**) | 22.2 | 29 |
| <i>Leaf:</i> | | | | | |
| Hattiesburg, Miss..... | 19 | 24 | 26 | 22.0 | 25 |
| <i>Pearl:</i> | | | | | |
| Jackson, Miss..... | 20 | 23 | (**) | 26.6 | 31 |
| Columbia, Miss..... | 18 | 23 | (**) | 24.5 | 25 |
| <i>West Pearl:</i> | | | | | |
| Pearl River, La..... | 13 | 21 | 21 | 13.1 | 21 |
| Do..... | 13 | 26 | (**) | 15.9 | 27, 30, 31 |
| MISSISSIPPI DRAINAGE. | | | | | |
| <i>French Broad:</i> | | | | | |
| Penrose, N. C..... | 13 | 14 | 15 | 14.5 | 15 |
| Asheville, N. C..... | 4 | 14 | 14 | 4.4 | 14 |
| <i>Big Pigeon:</i> | | | | | |
| Newport, Tenn..... | 6 | 14 | 14 | 9.0 | 14 |
| <i>Holston, North Fork:</i> | | | | | |
| Mendota, Va..... | 8 | 14 | 14 | 9.0 | 14 |
| <i>Ouachita:</i> | | | | | |
| Camden, Ark..... | 30 | 25 | (**) | 33.0 | 28 |
| <i>Sulphur:</i> | | | | | |
| Finley, Tex..... | 24 | 27 | 30 | 24.7 | 29 |
| Ringo Crossing, Tex..... | 20 | 9 | 9 | 20.0 | 9 |
| Do..... | 20 | 22 | 26 | 23.0 | 25 |
| WEST GULF DRAINAGE. | | | | | |
| <i>Trinity:</i> | | | | | |
| Dallas, Tex..... | 25 | 23 | 24 | 29.4 | 23 |
| PACIFIC DRAINAGE. | | | | | |
| <i>Willamette:</i> | | | | | |
| Eugene, Oreg..... | 10 | 29 | (**) | 16.5 | 30 |
| Albany, Oreg..... | 20 | 31 | 31 | 21.1 | 31 |
| Oregon City, Oreg..... | 12 | 31 | 31 | 12.3 | 31 |
| Jefferson, Oreg..... | 10 | 29 | (**) | 13.0 | 30 |
| South Fork, Oreg..... | 12 | 29 | 29 | 16.1 | 29 |

* Continued from November.

** Continued into January.

Atlantic drainage, Connecticut River.—Following heavy rains on the 5th, advisory warnings were issued on the 6th for sharp rises in the lower Connecticut River, and on the 7th the stage at Hartford, Conn., was 15.2 feet, 0.8 foot below the flood stage. Much of this water was caused by release of the surplus water at Bellows Falls, Vt., and Turners Falls, Mass. The waters carried away a temporary bridge at Brattleboro, Vt., entailing a loss of \$30,000. Another heavy rain occurred during the night of December 14–15, mail advices were issued to up-river points on the 14th, and general flood warnings were ordered at 9 a. m. of the 15th, with an indicated crest of 17 feet at Hartford. A stage of 18.8 feet was reached at 2:30 a. m. December 17, 2.8 feet above the flood stage. The excess above the forecast stage of 17 feet was doubtless due to the discharge of surplus water at dams above Hartford, the season having been so wet that there was no need for storage of the extra water. At White River Junction, Vt., the crest stage was 14.5 feet at 1 p. m. December 15, 1.5 feet above flood stage. No other flood stages were reported, and there were no losses worthy of mention.

There were also moderate floods in the Susquehanna River in the vicinity of Oneonta, N. Y., on December 3 and 12, flood stages having been slightly exceeded.

James River.—The James River, of Virginia, at Columbia, Va., was in flood on December 1, caused by heavy rains on November 30. It was a local flood, and the crest stage was 21 feet, 3 feet above the flood stage, but flood stages were not even approximated over other portions of the river, except at Richmond, where there was a crest stage of 9.7 feet on December 2, 0.3 foot below the flood stage; no damage was reported.

Roanoke River.—The Roanoke River flood of November continued through December 4, and the crest stage of 38.4 feet at Weldon on that day was 8.4 feet above the flood stage. The necessary warnings had been given on November 29 and December 1. Apparently little or no damage was caused by this flood.

Neuse River.—The flood stage of 14 feet was just about reached at Neuse, N. C., on December 1, and the river was above the flood stage of 14 feet on the 2d and 3d at Smithfield, N. C., 35 miles below Neuse, with a crest of 15.3 feet on December 2. Warnings were issued on December 1, but the crest stages occurred a day earlier than had been anticipated, the trouble having been due, partly at least, to the nonreceipt of early information from headwaters. Additional heavy rains on the 8th and 9th necessitated more flood warnings on the 9th for the Neuse River, a stage of 18 feet at Neuse, and Smithfield, N. C., being forecast for December 11. The crest stages on that date were 16.2 and 17.6 feet, respectively, flood stage being at 14 feet. On December 10 warnings were issued for a rise for several days in the Tar River, with a stage of 18 feet forecast for Tarboro, N. C., on December 13, and 15 feet for Greenville, N. C., on December 14. These stages were not reached, but on the morning of the 14th, the river at Greenville touched the flood stage of 14 feet.

Cape Fear River.—Warnings were issued on December 2 for a stage of 24 feet, or 2 feet above flood stage, by December 4 in the lower Cape Fear River, at Elizabethtown, N. C., and the crest stage was 22.4 feet on the 3d. On December 9 warnings were issued for a stage of 38 feet at Fayetteville, N. C., on the 10th, and for 27 feet

at Elizabethtown, N. C., on the 11th. The crest stage at Fayetteville was 42 feet, or 7 feet above flood stage, at 1 p. m. December 10, and at Elizabethtown 30.2 feet, or 8.2 feet above flood stage, on December 12.

The losses reported from these North Carolina floods amounted to only about \$3,000, while the money value of the property saved by the warnings was estimated at \$27,500.

The same general rain conditions that caused the North Carolina floods also extended to the southward and westward, and at Cheraw, S. C., on the Peedee River, the flood stage of 27 feet was exceeded by 1.9 feet on December 10. Although the flood stage had not been forecast, warnings had been issued to the lumber interests, and property to the amount of \$3,000 was saved. Advisory warnings were also issued on the 14th and 28th. In both instances the crest stages were slightly below flood stage.

The lower Santee River was in flood at the end of November, 1920, and flood stage continued throughout the month, with a crest stage of 14.1 feet at Rimini, S. C., on the 19th-20th, and of 13.5 feet at Ferguson, S. C., on the 20th, flood stage being at 12 feet at both places. Further advices regarding the flood were issued on the 15th and 27th, the latter extended so as to include the entire watershed of the Santee River.

As there is little or no grazing in the swamp region at this time of the year, and as the Santee River had been high or in flood since the middle of November, 1920, there was no damage from the floods.

East Gulf drainage.—There were very heavy rains over the watershed of the Alabama River on the 13th and 14th, and general flood warnings were issued on the 13th. While the flood stages were generally exceeded, the crests in the Tallapoosa and Alabama Rivers were lower by several feet than had been anticipated. Operation of the gates at Lock 12, Coosa River, and somewhat uneven rainfall distribution may have contributed to cause the discrepancies. Resulting losses and damage from the floods amounted to about \$15,000, and about the same amount was saved by the warnings. Warnings were issued at the same time for the Black Warrior and Tombigbee Rivers. The warning of December 14 for 46 or 47 feet in the Black Warrior River at Tuscaloosa, Ala., on December 15 or 16 was a failure, the crest stage having been but 25.2 feet (flood stage 46 feet) on December 15. As in the case of the Alabama River, uneven distribution of the precipitation was probably the cause of the failure of the forecast, as a sufficient amount to justify the forecast occurred at the reporting stations. The warnings of the 22d and 23d were not much below the forecast stage for the Black Warrior River, while for the Tombigbee River they were very accurate. Losses were very small indeed.

Floods were also general over the Pascagoula watershed of Mississippi on approximately the same dates as to the eastward, and the usual warnings were issued at the proper times for stages above the flood stage. The warnings were fully verified, as will be seen by the table and were the means of saving property valued at \$45,000. The losses and damage reached an approximate total of \$200,000.

The heavy rains of December 13 brought the waters of the French Broad River and tributaries to stages slightly above the flood stage. No warnings were issued and no damage was done. A similar occurrence was reported at Mendota, Va., on the north Fork of the Holston River.

The stage of 11.3 feet at Knoxville, Tenn., on the 15th was accurately forecast, but another forecast issued on

the 15th for a stage slightly above 13 feet on the following day (flood stage 12 feet) failed by about 2 feet, the crest having been only 11 feet. No damage was reported.

The flood in the Ouachita River of Arkansas was accurately forecast, and a crest of 33 feet, 3 feet above the flood stage, was reached at Camden, Ark., on December 28. The flood continued into January, 1921. The damage done was nominal.

Flood stages were just about reached at places along the Sulphur Fork of Red River on three dates during the month. No warnings were issued. The Trinity River at Dallas, Tex., was also above the flood stage on December 23 and 24, but without resulting damage. No other flood stages were reported along the river, although the stage at Trinidad, Tex., on December 27 was 25.8 feet, 2.2 feet below the flood stage.

The only other flood was in the Willamette River of Oregon. It was in progress at the close of the month, at which time the stage at Portland was 14 feet, 1 foot below the flood stage. A report on this flood will be made in the MONTHLY WEATHER REVIEW for January, 1921.

NOTE.—A report on the flood in the Eel River of California on November 17, 18, and 19, 1920, was received too late for publication in the November REVIEW. This flood was caused by heavy, warm rains, and melting snows, and caused damage to the amount of about \$60,000, of which perhaps \$50,000 was incurred by railroad interests. Warnings were issued as soon as possible, although somewhat late at first on account of unsatisfactory communications.

Estimated losses by floods.

| River and district. | Farms, buildings, machinery, livestock, etc. | Suspension of business. | Value of warning. | Tangible property, roads, bridges, etc. | Crops matured. | Crops prospective. |
|-------------------------------------|--|-------------------------|-------------------|---|----------------|--------------------|
| Raleigh, N. C.: Roanoke..... | | \$3,000 | | | | \$27,500 |
| Charleston, S. C.: Pee Dee..... | | | | | | 3,000 |
| Montgomery, Ala.: Coosa..... | \$200 | 10,700 | \$2,000 | | \$2,500 | 16,750 |
| Mobile, Ala.: Black Warrior..... | | | | | 1,500 | 2,000 |
| Meridian, Miss.: Leaf..... | 136,300 | 13,500 | 5,050 | \$24,950 | 19,650 | 45,000 |

MEAN LAKE LEVELS DURING DECEMBER, 1920.

By UNITED STATES LAKE SURVEY.

[Dated: Detroit, Mich., Jan. 5, 1921.]

The following data are reported in the "Notice to Mariners" of the above date:

| Data. | Lakes.* | | | |
|--|-----------------|---------------------|-----------------|-----------------|
| | Superior. | Michigan and Huron. | Erie. | Ontario. |
| Mean level during December, 1920: Above mean sea level at New York..... | Feet. 602.25 | Feet. 580.12 | Feet. 571.89 | Feet. 245.40 |
| Above or below— | | | | |
| Mean stage of November, 1920..... | —0.23 | —0.18 | —0.06 | +0.17 |
| Mean stage of December, 1919..... | —0.08 | —0.04 | +0.02 | —0.34 |
| Average stage for December, last 10 years..... | —0.05 | —0.01 | +0.15 | —0.06 |
| Highest recorded December stage..... | —0.88 | —2.46 | —1.64 | —2.21 |
| Lowest recorded December stage..... | +1.05 | +1.12 | +1.03 | +1.97 |
| Average relation of the December level to— | | | | |
| November level..... | | —0.20 | —0.10 | —0.20 |
| January level..... | | +0.20 | +0.10 | +0.00 |

* Lake St. Clair's level in December, 574.77 feet.